U.S. Department of Justice

Environment and Natural Resources Division

HKH
DJ #90-11-3-08278

Environmental Enforcement Section
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July 31, 2014

CONFIDENTIAL SETTLEMENT COMMUNICATION
Subject to Federal Rule of Evidence 408

By Electronic Mail (w/o Enclosures)
By Federal Express (w/ Enclosures)

Elizabeth H. Temkin, Partner
Joseph G. Middleton, Partner
Temkin Wielga & Hardt LLP
1900 Wazee Street, Suite 303
Denver, CO 80202

Dear Betsy and Joe:

This letter follows up on our conversation during the July 10, 2014, settlement meeting and my letter to you dated July 23, 2010. Specifically, I want to further address the matter of CoCa Mines, Inc.'s liability at the Gilt Edge Mine Site ("Site") under Section 107(a)(2) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9607(a)(2), as an operator at the time of disposal of hazardous substances. To help with your analysis of the issues, I have enclosed relevant documents. If there are other documents that are referenced, and you do not have access to them, please let me know and the United States will provide them to you.

As you know, the United States alleges that Congdon & Carey Ltd 5 (which later became CoCa Mines, Inc.) (jointly "CC/CM") is directly liable for the recovery of response costs pursuant to Section 107(a)(2) of CERLCA, 42 U.S.C. § 9607(a)(2), because it was an operator of the Site from 1975 through 1986.[1] For the reasons set forth in detail below, the United States will be able to show that CC/CM is liable as an operator under CERCLA.

[1] The United States also alleges that CC/CM is directly liable for the recovery of response costs pursuant to Section 107(a)(2) of CERLCA, 42 U.S.C. § 9607(a)(2), because it was an owner of the Site from 1976 through at least 1986 (when it sold its mining interests to Gilt Edge, Inc./Brohm Mining Corporation or "Brohm") and potentially through 1988 when it quitclaimed certain mining leases to Brohm. See COCA-01-010-11; COCA-01-021; COCA-01-025; COCA-01-025-28; COCA-01-136; COCA-01-070. The Courts have made clear that lessees are owners for purposes of CERCLA liability. In K.C. 1986 Limited Partnership v. Reade Mfg., 33 F. Supp.

Before turning to that issue, however, I want to respond to your assertion during our recent meeting that CC/CM merely "tapped" the Site in terms of its mining activities. This comment ignores the key role of CC/CM and Cyprus Mines Corporation ("Cyprus Mines") to prepare and market the Site for a full-scale, open-pit mine. As you know, the entire purpose of the Joint Venture between CC/CM and Cyprus Mines was to determine mining potential at the Site, bring in a major mining company to conduct full-scale operations, and make a profit on the royalties. Indeed, the parties actively marketed the Site to potential mining companies. See e.g. BC6017074 (1982 marketing document titled "Gilt Edge Mining Properties"); BC6013070 (1983 document titled "Outline for Discussion with Interested Mining Companies"). Furthermore, the mine development work conducted by the Joint Venture was substantial by any measure:

1) Property access and acquisition. See e.g. BC6017081
2) Geologic mapping. See e.g. BC0037358; BC6007629-30
3) Exploration drilling including 352 rotary and diamond core drill holes. See e.g. COCA-02311-12; PDC-002-015 (p.6); BC6000559; BC6007638; COCA-04425-50; COCA-00512-13; BAR-000591
4) Delineation of reserves. See e.g. BC00001317; BC40012889-936
5) Historic tailings metal analysis. See e.g. PCD-002-018 (p.10)
6) Underground mine development and adit construction. See e.g. COCA-00565 (1980 New King Tunnel); COCA-00566 (1980 Laron Tunnel); BAR-000667 (1984 Rattlesnake Tunnel)
7) Bulk sampling for metallurgical work. See e.g. COCA-00566 (3,000 tons of rock blasted from Sunday Pit area – 1,700 tons used at cyanide heap leach pad operated by parties)
8) Reclamation of cyanide heap leach pad. See e.g. BC30000001 (1983, parties disposed of material from cyanide heap leach pad to fill two ponds at Union Hill and to back fill the cut made at Union Hill)

Aside from the legal fact that CC/CM and Cyprus Mines are jointly and severally liable for the activities of the Joint Venture, this is an equitable matter. Congdon & Carey/ CoCa Mines has unclean hands. Mine development work at the Site from 1975 to 1986 led directly to Brohm coming to the Site and engaging in full-scale mining starting in 1988. Moreover, the parties made a profit from it. In 1986, the Joint Venture partners sold their interests in the mine to Brohm for $1.25M. See COCA-01-021.

2d 820, 833 (W.D. Mo 1998), the district court stated that "[l]essees are considered owners for purposes of determining CERCLA liability." (citing, among other cases, U.S. v. Mexico Feed and Seed Co., Inc., 980 F.2d 478, 484 (8th Cir. 1992)); see also Commander Oil Corp. v. Barlo Equip. Corp., 215 F.3d 321, 330-31 (2nd Cir. 2000) (where the Court provided a "non-exclusive" list of factors which can place owner liability under CERCLA upon lessees).

With regard to liability as an operator under Section 107(a)(2) of CERCLA, 42 U.S.C. § 9607(a)(2), the 8th Circuit has ruled, post-Bestfoods, on the standard.[2] See United States v. Bestfoods, 524 U.S. 51 (1998). In K.C. 1986 Ltd. Partnership v. Reade Mfg., 472 F.3d 1009, 1020 (8th Cir. 2007), the 8th Circuit upheld the district court's ruling that an individual with an ownership interest in a company that mixed and repackaged herbicides was liable because he was an operator of the facility "including those operations having to do with the leakage or disposal of hazardous waste and decisions about complying with environmental regulations." K.C. 1986, 472 F.3d at 1020 (citing Bestfoods, 524 U.S. at 66-67). Likewise, the facts in this case show that CC/CM had the authority to control the handling and disposal of hazardous substances at the Site, and did exercise such control. Far from being a passive participant at the Site, CC/CM throughout the years actively participated with Cyprus Mines, Amoco Minerals Company ("Amoco"), and Lacana Gold, Inc. (f/k/a Lacana Mining Company)("Lacana") in determining which operations to conduct at the Site, including those involving the disposal of hazardous substances and compliance with environmental regulations.

For example, in 1985, CoCa Mines was a party to an agreement to remediate "previously mined waste dumps and tailings" on the Commonwealth Mining Company ("Commonwealth") properties. See CO001544-49 (at p.2) (enclosed). Specifically, the agreement authorized Lacana to use these materials for such projects as "roadway construction, leach pad base, leach pad linings, etc." Id. Several months prior to the signing of the agreement, Lacana had received a water quality report related to the Site. See BC00022069-113 (enclosed). The report stated that:

> Site 2 [Lower Strawberry Creek] which is located immediately adjacent to and downstream from the existing tailing pile showed a number of apparent mining-related impacts. The pH value measured at the site was 3, indicating a strong acid-runoff/ "Groundwater" situation apparently caused by the exposure of sulfide minerals to weather and erosion (Table 6). This was evidenced by a long reach (estimated 1,000 feet) of the toe of the tailing pile being eroded and washing directly into the stream . . . [h]eavy metal concentrations including arsenic, antimony, copper, lead, zinc and mercury all were all [sic] elevated over the upstream values.

Id. at BC00022087-90. The 1985 agreement was the response to the problem of ongoing disposal of hazardous substances at the Site. Signed by CoCa Mines, Cyprus Mines, Lacana, and Commonwealth, it authorized the use of the mined waste dumps and tailings "for construction materials *while clearing up potential environmental hazards*." See CO001544-49 (at p.2) (emphasis added). Under CERLCA, "an operator must manage, direct or conduct operations specifically related to pollution, that is, operations having to do with the leakage or disposal of hazardous waste . . ." Bestfoods, 524 U.S. at 66–67. This document, by itself, is proof of CoCa Mines' liability as an operator at the Site under the Bestfoods/ K.C. 1986 standard.

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[2] Section 107(a)(2) of CERCLA, 42 U.S.C. § 9607(a)(2), provides that liability for the release of hazardous substances may be imposed on "any person who at the time of disposal of any hazardous substances owned or operated any facility at which such hazardous substances were disposed of." The statute defines "person" to include both individuals and corporations. See 42 U.S. C. §9601(21).

And yet there is another example of CC/CM's direct involvement in operations having to do with the disposal of hazardous substances at the Site. In 1979, Dolf W. Fieldman[3] sent a letter to Cyprus Mines setting forth a proposal to use nearby Homestake Mine to process Gilt Edge ore rather than the planned cyanide heap leach pad which had yet to be built. The letter cited concerns about the location of the site of the cyanide heap leach facility, "[s]ince the area is subject to flash floods, containment will be difficult, and approval of an [Environmental Impact Study] more difficult." See BC6010524-29 at p. 1 (enclosed). This same letter goes on to provide detailed analysis of cyanide leaching on-Site versus using nearby Homestake Mine for processing of ore. Id. at p. 5. The parties ultimately decided to use a cyanide heap leach pad for processing of their ore. In late May 1982, approximately 2,000 gallons of water containing cyanide overflowed into Strawberry Creek from the heap leach pad lower holding ponds, which was an unauthorized discharge of hazardous substance from the Site. See BC6014012 (enclosed).

Far from being a silent money partner in the Joint Venture, CC/CM was actively involved in operations at the Site, particularly as they related to analysis and recovery of precious metals. In 1977, Mr. Fieldman reported that he had advised Cyprus Mines that "since the evidence indicates that gold is held within the pyrite in the sulfide zone, that an attempt be made by flotation or heavy media to make a simple pyrite concentrate" that could possibly be sold to nearby Homestake Mine, which had excess mill capacity. See COCA-01-037 (enclosed). That same year, J.E. Worthington of Cyprus Mines followed up in a memo regarding Mr. Fieldman's suggestion "that there might be tungsten values in the Gilt Edge mineralization" and Mr. Fieldman's request to test samples for tungsten as well as gold, which Cyprus Mines did. See BRO-005071 (enclosed). In 1980, CoCa Mines Vice President J.C. Mitchell requested that Cyprus Mines conduct assay tests on samples for iron, copper, zinc and lead on a pyrite concentrate previously obtained from flotation tests. See BRO-007900-01(enclosed). In 1983, President of CoCa Mines Hugh Matheson, who had provided leach test reports on ores from the Site to consulting engineer Frank Seeton, received an opinion memorandum "as to whether the Gilt Edge ores should be treated by heap leaching or an agitated cyanide leach." See COCA-03115-16 (enclosed). The drilling and bulk sampling, among other activities, necessary for analysis and recovery of precious metals caused Acid Rock Drainage ("ARD") to be disposed of at the Site. Acid Rock Drainage at the Site contains hazardous substances within the meaning of CERCLA, including arsenic, cadmium, chromium, copper, lead, manganese, nickel and zinc. See 42 U.S.C. § 9601(14); see also 40 C.F.R. § 302.4(a) and Table 302.

The company's involvement in operations also extended to compliance with environmental regulations. Early on, CC/CM recognized that an environmental feasibility/impact study would be needed to obtain federal and state approval so that the mine could be brought into full-scale production. Mr. Fieldman made reference to this in his 1979 letter to Cyprus Mines. See supra BC6010524-29 (at p. 1) (enclosed). As the years went by, CoCa Mines began to push Lacana, which had taken over day-to-day operations from Cyprus Mines/Amoco, for this work to be completed. In early 1985, Lee (sic) Freeman of CoCa Mines attended a meeting in Denver with representatives of Lacana and Amoco. A memo to the file about this meeting by E.G. Thompson of Lacana stated the need to obtain "an EIS for CoCa."

[3] Mr. Fieldman was described as "our consulting geologist" by Thomas E. Congdon of Congdon & Carey in a letter dated October 4, 1978. See BC6000228-29 (enclosed).

See BRO-011314 (enclosed). Several months later, CoCa Mines Vice President J.C. Mitchell, in a letter about a proposed amendment to the Lacana (Mining) Agreement, stated that CoCa Mines wanted language inserted "to the effect that in consideration for the one year extension to the agreement, Lacana will diligently pursue environmental permitting and engineering related to the preparation of a preliminary feasibility study." See BRO-010428 (enclosed). "[A]n operator must manage, direct or conduct operations specifically related to pollution, that is, operations having to do with . . . decisions about compliance with environmental regulations." See Bestfoods, 524 U.S. at 66–67.

In sum, there is enough evidence in the record for a court to hold Congdon & Carey/ CoCa Mines liable as an operator under CERCLA, and several different ways to get there.

Sincerely,

Heidi K. Hoffman

Heidi K. Hoffman

cc: Andrea Madigan, U.S. EPA
Sharon Abendschan, U.S. EPA
Amelia Piggott, U.S. EPA

December 17, 1984

AGREEMENT

THIS AGREEMENT is made and entered into as of this 21st day of FEBRUARY, 1985, by and between: LACANA GOLD INC., a Nevada corporation, P.O. Box 11305, Reno, Nevada 89510 ("LACANA"); CYPRUS MINES CORPORATION, a Delaware corporation, P.O. Box 3299, Englewood, Colorado 80155 ("CYPRUS"); COCA MINES INC., a Colorado corporation, 1776 Lincoln Street, Suite 910, Denver, Colorado 80203 ("COCA"); and COMMONWEALTH MINING COMPANY OF SOUTH DAKOTA, a South Dakota corporation, c/o R. E. Meyer, P.O. Box 995, Oshkosh, Wisconsin 54901 ("COMMONWEALTH");

W I T N E S S E T H:

WHEREAS as of October 16, 1974 COMMONWEALTH entered into and granted a Lease and Option to Purchase Agreement to Thomas E. Congdon for certain patented and unpatented claims generally located in Lawrence County, South Dakota, hereinafter referred to as the "Subject Property", with said Lease and Option to Purchase Agreement being duly recorded in Lawrence County, South Dakota on November 12, 1974 in Book 418, at Pages 264-284; and

WHEREAS by mesne assignments, conveyances and other agreements COCA and CYPRUS have succeeded to the interest of Thomas E. Congdon; and

WHEREAS LACANA (nee' Lacana Mining Inc.) entered into a Mining Agreement dated as of June 1, 1983 with CYPRUS and COCA to acquire the Subject Property and other mineral properties in

Lawrence County, South Dakota, as is evidenced by that certain Assignment of Leases - Memorandum for Recording, recorded in Lawrence County, South Dakota, as Document #83-5768, on October 18, 1983; and

WHEREAS LACANA formerly was known as Lacana Mining Inc., the name change being effectuated by appropriate documents filed with the Nevada Secretary of State on July 9, 1984; and

WHEREAS LACANA has spent the 1983 and 1984 exploration seasons drilling and developing the ore reserves of the Subject Property and neighboring mineral properties and is now considering putting such properties into production; and

WHEREAS the Subject Properties have previously mined waste dumps and tailings of marginal mineral value that could be used by LACANA for construction materials while clearing up potential environmental hazards;

NOW THEREFORE, for and in consideration of the sum of TEN AND 00/100 DOLLARS ($10.00), the receipt and sufficiency of which is hereby acknowledged by CYPRUS, COCA and COMMONWEALTH, and for the consideration recited in the 1974 Lease and Option to Purchase and the 1983 Mining Agreement, the parties hereto agree as follows:

1. That LACANA may use any and all previously worked mine waste dumps and/or tailings material that are present on the Subject Property for any purpose associated with bringing the Subject Property or any portion thereof into production, including, but not limited to, using such materials for roadway construction, leach pad base, leach pad linings, etc.

2. That CYPRUS, COCA and COMMONWEALTH shall be entitled to their respective shares of royalties (if any) as set forth in their respective agreements controlling the Subject Property should LACANA recover any saleable minerals or metals from that portion of said previously mined waste materials or tailings placed (as lining material or otherwise) on the leach pads planned by LACANA, or otherwise.

3. That Paragraph 1 and 2 above only set forth understandings between the parties hereto and nothing contained herein is intended to modify the substance of the 1974 Lease and Option to Purchase Agreement or the 1983 Mining Agreement.

IN WITNESS WHEREOF, the parties hereto have hereunto set their hands as of the day and year first above written.

LACANA:

LACANA GOLD INC., a Nevada corporation

BY: _____

TITLE: _____

CYPRUS:

CYPRUS MINES CORPORATION, a Delaware corporation

BY: Ralph E. Anderson

TITLE: Vice-President

December 17, 1984

COCA:

COCA MINES INC., a Colorado corporation

BY: Hugh J. Mullen

TITLE: Pres.

COMMONWEALTH:

COMMONWEALTH MINING COMPANY OF SOUTH DAKOTA, a South Dakota corporation

BY: Robert L. Bryan

TITLE: Pres.

STATE OF Nevada)
) SS.
COUNTY OF Washoe)

On this the 11th day of January, 1985, before me, Wilma P. Hatter, the undersigned officer, personally appeared E. B. Thompson, who acknowledged himself to be the President of LACANA GOLD INC., a corporation, and that he, as such President, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself as President.

In witness whereof, I hereunto set my hand and official seal.

Wilma P. Hatter
NOTARY PUBLIC

WILMA P. HATTER
Notary Public - State of Nevada
Appointment Recorded in Washoe County
MY APPOINTMENT EXPIRES MAR. 23, 1987

December 17, 1984

STATE OF Colorado)
) SS.
COUNTY OF Arapahoe)

On this the 28th day of March, 1985, before me, G. Irene Johnson, the undersigned officer, personally appeared Ralph E. Anderson, who acknowledged himself to be the Vice President of CYPRUS MINES CORPORATION, a corporation, and that he, as such Vice President, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself as Vice President.

In witness whereof, I hereunto set my hand and official seal.

G. Irene Johnson
NOTARY PUBLIC
7000 S. YOSEMITE ST.
ENGLEWOOD, CO 80112

My Commission Expires December 26, 1985

STATE OF Colorado)
CITY AND) SS.
COUNTY OF Denver)

On this the First day of April, 1985, before me, Vicki L. Ferguson, the undersigned officer, personally appeared Hugh J. Matheson, who acknowledged himself to be the President of COCA MINES INC., a corporation, and that he, as such President, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself as President.

In witness whereof, I hereunto set my hand and official seal.

My Commission Expires Nov. 22, 1988

Vicki L. Ferguson
NOTARY PUBLIC
1776 Lincoln St.
Denver, CO 80203

December 17, 1984

STATE OF Wisconsin)
) SS.
COUNTY OF Kenneboys)

On this the 4th day of February, 1985, before me, Carol Jean Schumann, the undersigned officer, personally appeared Robert E. Meyer, who acknowledged himself to be the President of COMMONWEALTH MINING COMPANY OF SOUTH DAKOTA, a corporation, and that he, as such President, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself as President.

In witness whereof, I hereunto set my hand and official seal.

Carol Jean Schumann
NOTARY PUBLIC
My Commission expires
November 1, 1987

JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.

1301 Vista Avenue Argonaut Building, Suite 210, Boise Idaho 83705 / (208) 345-5865

1568.0010

August 28, 1984

Mr. Ritch Hall
Lacana Gold, Inc.
P. O. Box 485
Deadwood, SD 57732

Subject: Water Quality Monitoring Program
Lacana Gilt Edge, South Dakota Mining Project

Dear Ritch:

Enclosed are two copies of the Water Quality Monitoring Technical Memorandum (T.M. No. 5). The information describes the monitoring program, and summarizes the results of the June sampling event (high flow), and compares the data to current standards and/or criteria which will apply to the Gilt Edge project.

The report should be considered a draft, at this time. I intend to expand the range of parameters discussion to include both high and low flows. We should see some interesting effects of low flow conditions on local water quality. Also, I will expand the comparative discussion on Stibnite. The preliminary data also indicate some interesting parallels we may be able to take advantage of. The effects of the "winze" drainage and/or groundwater system needs more study.

I would like to recommend that you hold off sending the report to the DW&NR until we have discussed the results in detail. This can be done in early September, or after the last monitoring event results are complete in late September. Again, a work session in Coeur d'Alene is recommended the second week in September to discuss these results and the overall program sequence. If we can then take a week and meet with the fisheries/wildlife people, firm up their scope of work and schedule, complete the last round of water quality sampling, set up the neutralization tests, and re-activate the agencies, given the increasingly tight schedule, maybe this would be the best way to go. This could be done the first week in October. I could work on the scope of work for the biological subcontractors ahead of time and get a preliminary approval from the Department of Game, Fisheries and Parks. A Sunday through Sunday effort might do a lot to "catch-up".

I'll call you after Labor Day. Hope all is well!

Sincerely,

Rick Richins/ln

Rick Richins

/ln

Enclosure

cc: Paul Dircksen

TECHNICAL MEMORANDUM NO. 5

WATER QUALITY MONITORING PROGRAM
LACANA GILT EDGE, SOUTH DAKOTA MINING PROJECT

TO: Ritch Hall, Manager
Special Projects

DATE: August 16, 1984

FILE NO: 1568.0010

FROM: Rick Richins

CLIENT: Lacana

SUBJECT: Gilt Edge Water Quality
Monitoring Program

INTRODUCTION

This memorandum briefly describes the existing water quality monitoring network for the Gilt Edge project and rationale for site selection, results of the initial water quality monitoring conducted at the site, and recommendations related to ongoing water quality monitoring needs. In addition, applicable water quality criteria and/or standards are also discussed, and a limited comparative analysis provided for key monitoring sites in terms of a "typical" baseline non-impacted stream, based on actual monitoring data from a similarly planned operation in central Idaho. Additional comparisons will be made after the September monitoring at Gilt Edge, and as the water quality data base is expanded for a full-scale operation.

The primary objective of the water quality monitoring program is to establish environmental baseline (pre-project conditions) at the site. This information will also be utilized to assist in determining "design points". These points will utlimately constitute collection locations of the major affected basins and subbasins for both storm runoff and snowmelt runoff and water quality monitoring stations.

DESCRIPTION OF WATER QUALITY MONITORING PROGRAM/SAMPLING SITES

The initial water quality monitoring network was established in May, 1984, as an element of the Exploration Plan of Operations, Test Sampling and Process Project Report, prepared by Lacana with assistance from James M. Montgomery, Consulting Engineers, Inc. (JMM). For the purposes of the plan, the study area was divided into major drainage basins. Principal streams to be monitored included: Strawberry Creek and Bear Butte Creek. Other streams to be evaluated in the field for

accessibility, monitoiring needs, and location in relation to potential siting of major mining facilities (leach pads, processing plant, waste dumps, etc.) included: Ruby Gulch Creek, Butcher Gulch Creek, and Two Bit Creek. It was felt that this approach would allow for the development of a long-term correlation between pre-project baseline conditions (both water quality and surface water hydrology), and the potential effects of constructing the proposed pilot plant test project and a future full-scale operation at the site.

Locations for the initial water quality monitoring stations are shown in Figure 1. Table 1 provides a summary description of the 11 monitoring sites sampled during the June 14, 1984 trip to the site. During this monitoring trip, all proposed sites were reviewed in the field. Monitoring included primary surface water sites, groundwater samples from the Rattlesnake Winze, and several selected onsite and offsite baseline "targets". These "targets" were selected due to anticipated water quality problems and/or existing conditions which warranted additional investigation. The sites are discussed in more detail later in this memorandum.

All sites were located, staked and photo-documented by JMM and Lacana personnel. The photographic index prepared includes 3 x 5 inch color photographs keyed to a 1-24,000 scale map. Physical conditions including temperature, weather, sampling and preservation techniques and other pertinent observations were also recorded. The photographic index is on file at the JMM Boise office, along with more detailed narrative descriptions of the sample sites.

EXISTING WATER QUALITY STANDARDS

The State of South Dakota Surface Water Quality Standards (Chapter 74:03:02) are a compilation of regulations which implement provisions of the Federal Water Pollution Control Act (33 U.S.C. 1151 et sea.) to provide for protection of the environment and promotion of personal health; and to thereby protect and promote the health, safety and general welfare of the people of the state. The standards are based on compliance with criteria of a beneficial use, and are updated on a continuing basis. Regulatory requirements also involve certification that National Pollution Discharge Elimination System (NPDES) and 404 Dredge and Fill permits are in compliance with State surface water quality standards.

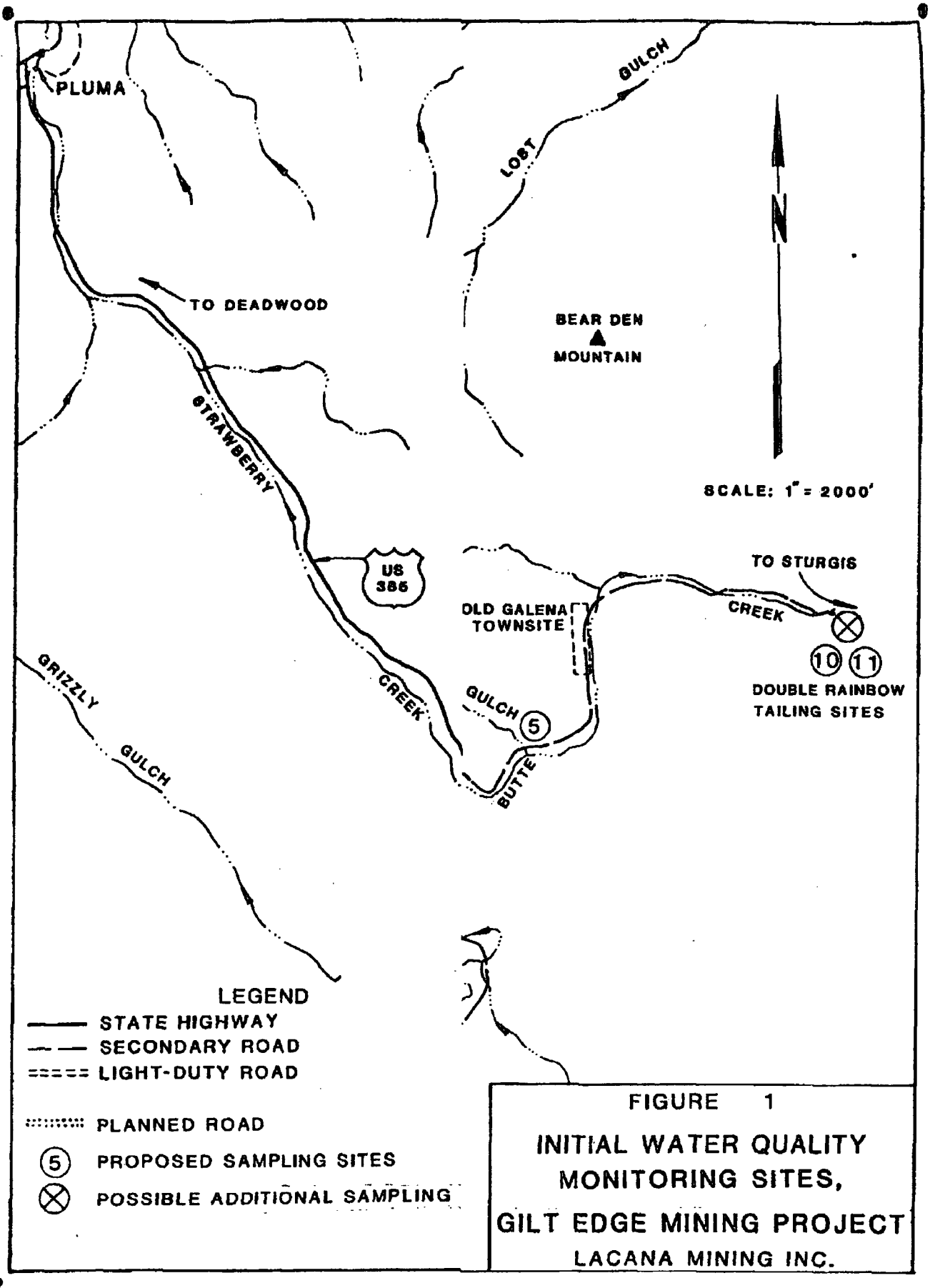


FIGURE 1

INITIAL WATER QUALITY MONITORING SITES,

GILT EDGE MINING PROJECT

LACANA MINING INC.

BC00022072

TABLE 1

LACANA MINING, INC. GILT EDGE MINING PROJECT
SURFACE WATER QUALITY MONITORING SITES

Site Location	Rationale for Monitoring	Parameters
1. Upper Strawberry Creek (upper fork near headwaters, spring source, sampled from ponded excavation site)	Headwaters of Strawberry Creek, above all proposed mining-related activities and the existing tailing pile. Fork draining western portion of Anchor Hill is intermittent. Main fork is perenniel. Represents premining baseline conditions for primary basin to be impacted. Location is also upstream from existing Cyprus pilot plant and potential future full-scale mining project mine areas. Access is good.	Water Quality (S.W.Q.), Fs
2. Lower Strawberry Creek (through reach draining existing tailing pile; immediately downstream from heavily eroded area.	Downstream from existing tailing pile, above the confluence with Bear Butte Creek. Station representative of water quality effects of major existing fine sediment source (tailing pile) in the drainage. Potential full-scale project mine areas would also drain to this site. Access is good.	Water Quality, Fs
3. Upper Bear Butte Creek (100 ft. above Strawberry Creek)	Upstream from confluence with Boomer Gulch Cr. (intermittent) and Strawberry Creek (perennial). Representative of pre-mining baseline conditions. Access is good.	Water Quality, Fs
4. Lower Bear Butte Creek (100 ft. downstream from confluence with Strawberry Creek)	Downstream from confluence with Strawberry Creek. Station indicates effects of Strawberry Creek drainage and test pit sites on Bear Butte Creek water quality. Future potential exploration targets also drain to this monitoring location. Access is good.	Water Quality, Fs
5. Ruby Gulch Creek (100 ft. upstream from confluence with Bear Butte Creek)	Site drains to Bear Butte Creek. Located in same drainage as pilot plant. Creek is intermittent. Lower Ruby Creek access is good.	Water Quality (S.W.Q.)

TABLE 1 (cont.)

Site Location	Rationale for Monitoring	Parameters
6. Upper Butcher Gulch Creek (at site of old Anchor Mountain workings)	Monitoring site location is representative of pre-operations conditions for mining. Previous activities included Anchor Mountain Mine workings. Test heap site drains to this area. Potential site for full-scale leaching operation. Access is good.	Water Quality (S.W.Q.), Fs
7. Two Bit Creek (Northwest Anchor Hill Area)	Located in drainage which full-scale processing facility could be constructed. Represents no recent mining activity. Potential waste dump sites also located in basin. Access is good.	Water Quality (S.W.Q.), Fs
8. Abandoned Cyprus Pilot Plant Site (at plant site)	Baseline residual cyanide monitoring (treated ore runoff).	Sel. Par.
9. Rattlesnake Winze (Underground working; winze approximately 180 ft. deep)	Access to mine drainage/"groundwater".	Sel. Par.
10. Above Double Rainbow Tailing Site (100 ft. above existing workings and tailing pile)	Baseline for Double Rainbow tailing site.	Water Quality, Fs
11. Homestake Double Rainbow Mining Company Tailing Site (100-150 ft. south of tailing runoff and Bear Butte Creek)	Bear Butte Creek below old mine workings. Existing water quality problem site. Potential acid mine drainage.	Water Quality, Fs

Water Quality - Monitoring during high, mid-season, low flows.
Fs - Seasonal flow monitoring in conjunction with W.Q. monitoring
S.W.Q. - Seasonal (high flow) water quality monitoring due to intermittent flows (parameters may also be reduced).
Sel. Par. - Selected water quality parameters.

Criteria for coldwater permanent fish life propagation waters are described in Chapter 74:03:02:34. These address physical parameters (such as temperature, turbidity, and pH), chemical parameters (examples include sulfates, nitrates and heavy metals), and biological parameters. Table 2 provides a summary of specific water quality criteria for designated uses in the state, and certain water quality standards considered relevant to the project.

INITIAL (SPRING) 1984 WATER QUALITY MONITORING

During the initial monitoring event (June, 1984), 10 surface water sites and one groundwater site were sampled. Additionally, samples were collected from the Cyprus pilot plant overflow pond, standing or ponded water at the pilot plant, and direct runoff from the old tailing pile.

Sample stations for the baseline program were located in order to establish ambient baseline water quality conditions and to facilitate reproducible sampling. The sites were situated to best detect and document any potential degradation from existing land disturbances, or any changes in future background levels as a result of the proposed mining activities. The initial monitoring network was reviewed by the DW&NR prior to implementing the baseline program in the spring of 1984.

Water quality samples were collected in acid washed and rinsed containers on June 2 and 14, 1984. The parameters that were sampled and analyzed are listed in Table 3. Field measurements were recorded for temperature. Other physical parameters were measured at the laboratories (EPA-approved) in Pasadena and Boise. General site and weather conditions were also recorded.

TABLE 2

SELECTED WATER QUALITY CRITERIA SUMMARY

Parameters	Domestic Water Supply	Primary Contact Recreation	Cold Water Biota	Salmonid Spawning
Fecal Coliform		500/100 ml[A,B.] *Geometric Mean of* 500/100 ml based *on min. of* 5 samples per 30 days		
Total Coliform		1000/100 ml in 20% of total samples per 30 days or 240/ml Geometric Mean		
Dissolved Oxygen (mg/l)			6[A]	6 or 90% Saturation[A]
Temperature (°C)			65°F[A]	
pH			6.5-8.3[A]	6.5-8.8[A]
Turbidity (FTU)				
Unionized Ammonia (mg/l)			0.02	0.04 mg/l or less[B]
Nitrate - N mg/l)	10.0[A]			
Total Suspended Solids (mg/l)			Should not reduce depth of compensation point for photosyn. by more than 10%[C]	
Fluoride (mg/l)	1.4-2.4[B] (Temperature dependent)		1.5[D]	
Sulfate (mg/l)	250[D]		500[A]	
Free Cyanide (mg/l)	0.2[B]		0.005[A] (0.2[B]*	
Total Cyanide (mg/l)			0.02[A]	
Total Chlorine Residual mg/l)			0.02[A]	
Aluminum (mg/l)			1.0[C]	
Arsenic mg/l)	0.05[A]		0.05[A]	
Cadium mg/l)	0.01[A]		0.010[A]	
Chromium	0.05[A]			
Iron (mg/l)	0.30[B]		1.0[B]	
Manganese (mg/l)	0.05[B]			
Mercury (mg/l)	0.002[A]		0.002[C]	
Nickel (mg/l)			0.1 of 96 hr. LC50[C]	
Copper (mg/l)	1.0 mg/l			
Sodium (mg/l)	10.0[C]			
Zinc (mg/l)	5.0[B]		0.1 of 96 hr. LC50[C]	
Lead (mg/l)	0.05[A]		0.05[A]	

[A]State of South Dakota Department of Water and Natural Resources Surface Water Quality Standards, 1984.

[B]U.S. Environmental Protection Agency, Quality Criteria for Water, Pre-Publication Copy. (Criteria is from copy of Quality Criteria for Water. These criteria have not been adopted and can only be used as recommended limits).

[C]California State Water Resources Control Board, Water Quality Criteria, 2nd Edition, McKee & Wolf, 1973.

[D]U.S. Environmental Protection Agency, National Interim Drinking Water Standards, December, 1975.

*Land application criteria.

TABLE 3

TYPE OF ANALYSIS
WATER QUALITY ANALYSIS

PARAMETERS

Electrical Conductivity	Hardness (as $CaCO_3$)
Total Kjeldahl Nitrogen	Arsenic
Ammonia (N)	Iron
Nitrate (N)	Mercury
Total Phosphorus	Magnesium
Sulfate	Sodium
Temperature	Antimony
Total Suspended Solids	
Total Dissolved Solids	
Turbidity (FTU)	
pH (units)	
Cyanide (total*, free, weak acid dissociable*)	

*Selected analyses.

All chemical samples were preserved and analyzed by standard EPA-approved methods as presented in the Standard Methods for the Examination of Water and Wastewater, 15th Edition, except as otherwise indicated. Table 4 indicates the method of anlaysis utilized for chemical and physical parameters. Samples were preserved and shipped on ice to laboratory facilities in Boise for analysis. Samples were preserved according to standard EPA-recommended procedures as follows: Total Kjeldahl Nitrogen, COD, -20 ml 10% H_2SO_4; metals -20 ml 10% HNO_3.

TABLE 4

LABORATORY ANLAYSIS TECHNIQUES AND DETECTION LIMITS

Parameter (units)	Detection Limit	Method
Temperatures (^{o}C)	N/A	Thermistor*
Dissolved oxygen (mg/l)	N/A	Membrane electrode*
pH (S.U.)	N/A	Electrometric*
Specific conductance (!mhos/cm, 25^{o}C)	N/A	Wheatstone bridge
Hardness (mg/l as $CaCO_3$)	0.1	EDTA titrimetric
Total suspended solids (mg/l)	0.1	Gravimetric
Turbidity (NTU)	.01	Nephelometric
Total Kjeldahl nitrogen (mg/l as N)	.50	Colorimetric
Total phosphorus (mg/l as P)	.005	Colorimetric
Sulfate (mg/l)	0.1	Colorimetric
Total organic carbon (mg/l)	0.1	Combustion
Total coliform bacteria (MPN/100 ml)	N/A	Muliple tube fermentation
Arsenic (mg/l)	.001	Graphite furnace AA
Calcium (mg/l)	.02	Flame AA
Iron (mg/l)	.03	Flame AA
Magnesium (mg/l)	.01	Flame AA
Manganese (mg/l)	.001	Graphite furnace AA
Mercury (mg/l)	.0002	Cold vapor AA
Sodium (mg/l)	.002	Flame AA

The results of the sampling for the 11 primary sites are presented in Tables 5 through 15. Also presented in these tables are value ranges for a stream considered representative of a "typical" mining-impacted high mountain stream reach (based on actual data) affected by previous exploration and development. This project, the Meadow Creek Mines, was in operation during World War I through the Korean War at the Stibnite, Idaho site. The results of the "target" monitoring program will be discussed in a subsequent memorandum.

A summary discussion of the results by water quality monitoring site follows. Once the September (low-flow) event has been sampled for the Gilt Edge project, a more detailed discussion of the stations according to key water quality parameters will be prepared by JMM. This will include descriptions of individual parameters and

their relevance to existing water quality conditions in the apparent "zone of influence" for a future full-scale mining operation.

Primary Parameters

Ten parameters were determined to be the most critical indicators of potential water quality changes in the streams and drainages and other target monitoring sites for the Gilt Edge project. The parameters include:

- Temperature
- Turbidity
- Total suspended solids
- Total dissolved solids
- Electrical conductivity
- pH
- Iron
- Arsenic
- Lead
- Cyanide

A brief description of these parameters and their relationships to surface water quality and fisheries and aquatic life protection follows. Specific criteria (level associated with degree of environmental affect) or standards (legal level for a particular reach of water way or for an effluent are also presented, as appropriate. These parameters will provide an indication of any major changes in water quality that could be expected within the study area.

Temperature (^{o}C). Variations in stream temperature are a natural function of flow patterns, and seasonal and diurnal air temperature. However, a variety of man-related activities can have an effect on water temperature. The stripping of natural vegetation shading a stream or the change of a stream gradient and resultant velocity are two of the most common and impacting activities which can affect water temperature. The primary effect of changing water temperature is on the biological communities with the systems. Temperature is a prime regulator of the natural processes within a water environment.

Other affects on water quality-related temperature variations and aquatic life include: a) higher temperatures diminish the soluability and availability of dissolved oxygen; b) elevated temperature increase metabolism, respiration and oxygen demand of fish and other aquatic life; and c) toxicity of many substances is increased as temperature rises. Because fish and other motile organisms seek a preferred temperature at which they can best survive, changes in water temperature can result in corresponding changes in fish and other aquatic organism populations. If the temperature of a reach of stream is raised by 5-10°C, cold-water game fish will normally avoid this reach and eventually be replaced by coarse warm-water fish.

Turbidity (FTU). Turbidity is essentially a determination of the total light reflecting solids within an aquatic medium. Its ease of field and laboratory measurement is the primary reason it has been established a critical parameter for the water quality monitoring program. Like total suspended solids (TSS), an increase in turbidity can result in a variety of biological and physical changes in the environment. This includes modification of the temperature structures of a stream. By interfering with the penetration of light, turbidity also militates against photosynthesis, and thereby decreases primary productivity and the aquatic food base.

The State of South Dakota has established a criteria for all the waters in the state that prohibits any activity that results in an increase of 5 JTU (Jackson Turbidity Units) over the natural occurring level. This standard was developed to detect relatively significant variations in existing water quality, and therefore utilizes the JTU which is capable of measuring changes in the range of 5 units. The Nephelometric Method which utilizes the FTU turbidity unit of measure will be utilized during the remainder of the monitoring program at Gilt Edge. The detection limit is 0.01. This procedure was chosen because it can detect more subtle changes in background levels.

Total Suspended Solids (TSS). Total suspended solids (TSS) are those materials that remain a particulate suspended material in the flow regime of a water body. They include materials introduced both from point and nonpoint sources such as wastewater effluent, erosion runoff, resuspended streamload and almost any other form of solids or sediment. TSS is significant in that it can, among other things, reduce

the penetration of light and thus the aquatic photic zone, affect fish propagation by covering bottom spawning areas, reduce or change the diversity of benthic bottom dwelling invertebrates, increase water temperature by solar absorption, and have an overall negative impact on cold water fishery.

Aside from the aesthetic impacts of the toxicity of the material, TSS concentrations over 90 mg/l are known to have an adverse affect on trout and other cold water fish (McKee and Wolf, 1963). The EPA criteria for solids (suspended and settleable) states that the concentrations shoudl not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life (EPA, 1976).

The significance of TSS in streams draining the Gilt Edge project area involves the potential for surface runoff from the mining operation and seepage from leached ore or tailing disposal facilities to enter local streams and adversely affect water quality and freshwater aquatic communities.

Total Dissolved Solids. Dissolved solids normally ocnsist of carbonates, bicarbonates, chlorides, sulphates, phosphates and possibly nitrates of calcium, manganese and other substances. All salts in solution change the physical and chemical nature of the water and exert osmotic pressure. Salt concentrations can also display synergistic and antagonistic effects on water quality and fish and aquatic life, particularly in the case of heavy metals and in some cases cyanides.

In general, dissolved solids up to the following limits should not interfere with the indicated beneficial uses:

- Domestic water supply - 1,000 mg/l
- Irrigation - 700 mg/l
- Stock watering - 2500 mg/l
- Fish and aquatic life (fresh water) - 2,000 mg/l

Electrical Conductivity (EC). Natural inland waters usually contain relatively small quantities of mineral salts in solution. All substances in solution in water collectively exert osmotic pressure on the organisms living in the water body. Most

species can tolerate some changes in the relative amounts of salt normally present. Wide variations in salt content, however, can have far-reaching effects on stream fauna and flora. In polluted waters the salt concentration may rise to levels harmful to living organisms. When the osmotic pressure is sufficiently high because of salts in solution, water may be drawn through the gills of fish causing considerable cell damage or death.

In studies of water used for irrigation and fish production the residue in solution or salinity is often expressed as specific electrical conductance. The specific conductance of streams and rivers supporting a good mixed fish fauna can range from 150 to 500 micromhos per cm; while waters with specific electrical conductance between 2,000 and 3,000 micromhos per cm are limited to less restrictive uses such as irrigation. In waters supporting a good cold water fishery, five percent had a specific conductance under 50 micromhos, 50 percent under 270 micromhos and 95 percent under 1110 micromhos.

pH (Hydrogen Ion Activity). pH is by relative interpretation the measure of the acid/basic conditions in a medium. The effect of altering the pH within a stream system or introducing a water source with a high or low pH can be very complicated and involved. Depending upon the natural buffering capacity within the system, it can result in a variety of problems including changes in dissolved solids and osmotic properties, with corresponding effects upon living organisms.

A pH of 7 is considered neutral; below 7 acid; and above 7 alkaline. The pH of most productive fresh natural water is between 6.5 and 8.5, and is determined primarily by current biological processes and the chemical nature of the substrate (EPA, 1976). This natural buffer makes it possible for small amounts of acid or base to dissolve in waters without causing appreciable changes in pH.

Toxicity can also be markedly affected by changes in pH because the toxicity of many compounds is affected by the degree of dissociation. One such example is hydrogen cyanide (HCN). Cyanide toxicity to fish increases as the pH is lowered because the chemical equilibrium is shifted toward an increased concentration of HCN.

Iron (Fe). Iron is a common element that may occur in two primary forms in the aquatic environment, ferrous (Fe^{++}) and ferric (Fe^{+++}). Iron is an essential trace element required for plants and animals. However, in higher concentrations it can be toxic to fish and other freshwater aquatic life.

The EPA criteria for maximum concentration of iron is 0.3 mg/l for domestic water supplies, and 1.0 mg/l for protection of freshwater aquatic life. The deposition of iorn hydroxides on the gills of fish can cause irritation and blocking of respiratory channels. Heavy iron precipitates many also smother fish eggs.

Arsenic (As). Arsenic exists in both organic and inorganic compounds and can be trivalent or pentavalent. These compounds are insoluable in water. The most toxic forms of arsenic are trivalent inorganicx arsenicals. Arsenic is very toxic to human beings, and because of its slow excretion accumulates in the body so that small doses can become fatal with time.

Aquatic organisms also accumulate arsenic, but it does not appear to progressively concentrate through the food chain. Arsenic consumed in flesh appears to have a low toxicity. Aquatic organisms also accumulate arsenic, and it now appears that arsenic may be accumulated and biomagnified in the aquatic food chain to some degree. The EPA criteria for maximum concentration of arsenic is 0.05 mg/l for domestic water supplies (health), and 0.05 mg/l for fish and other aquatic life.

In its elemental form, arsenic may occur in small quantities in nature, but usually is found as the arsenides of true metals or as arsenopyrites. During ore processing, arsenic may be oxidized and recovered as arsenic trioxide.

Lead. Lead and its compounds may be present as a result of natural occurence, or as a result of mining, smelting, processing, and use. The toxicity of lead in water is affected by pH, hardness, organic materials and the presence of other metals. Lead tends to bioaccumulate in animal tissues. Levels as low as 0.01 mg/l have been shown to have detrimental effects on fish and aquatic life. State of South Dakota criteria require that lead may not exceed 0.05 mg/l for coldwater permanent fish life propagation waters.

Cyanide. Background concentrations of cyanide compounds in natural waters are usually extremely low. These compounds, however, have been extensively used in industry and particularly the mining industry for some time. Cyanide is extremely toxic in its free form in aqueous solutions. Complex cyanides are more stable than the original compound, and subsequent dissociation is relatively minor.

The principal method used in milling of gold is cyanidation. The basic principle of this process is that cyanide solutions have a preferential dissolving action for precious metals contained in an ore. A large variety of cyanide compounds and their derivatives are present in the barren solutions and waste effluents resulting from cyaindation of gold-bearing ores. These include free cyanide, simple compounds, weak complexes, moderately strong complexes, and strong complexes. In general, the stronger the cyanide complex, the less free cyanide is required to maintain it in solution, and the less readily it dissociates to yield cyanide ions. A more detailed discussion of cyanide and the cyanidation process is included in a separate Technical Memorandum. For the purposes of this discussion, the following general criteria are utilized:

Free cyanide - 0.2 mg/l; acceptable criteria for land disposal (also Drinking Water Standard)

Free cyanide - 0.005 mg/l; acceptable instream standard (South Dakota)

Total cyanide - 0.02 mg/l; acceptable instream standard (South Dakota)

SUMMARY OF RESULTS

Site 1, Upper Strawberry Creek

Water quality conditions in upper Strawberry Creek can generally be classified as good, as would be expected. No previous major land use disturbance has occurred in these reaches of the drainage.

The results of water quality analyses for the 8 primary and remaining parameters showed no unusually elevated levels (Table 5). The pH value was within the range of

TABLE 5

LACANA GILT EDGE, SOUTH DAKOTA MINING, SITE 1
ENVIRONMENTAL MONITORING DATA REPORT

Date Sample Collected: June 2, 1984

Conditions: Cloudy early morning, light rain, sun breaking out about noon. Air temperature (ambient) ranged from 12-16.5°C.
Water Temperature: 8.5°C

Sample Site: Site 1, Upper Strawberry Creek

Parameter	Units	Value	Typical Background Value Range (baseline impacted)*	Key Instream Standards or Criteria (mg/l)	Comments (field observations; other pertinent information)
Turbidity	FTU	N.A.	0.21-1.8	5 NTU over background	To be added during
pH	units	7.2	7.28-7.8	6.5-8.8	September/October
Electrical conductivity	µmho	110	20-129		sampling event.
Ammonia (NH_3-N)	mg/l	.18			
Nitrate (NO_3-N)	mg/l	<.015	0.1-0.1		
T.K.N.	mg/l	1.83	0.10-1.10		
Total Phos (P)	mg/l	.2	0.013-0.011		
Sulfate	mg/l	42	0.3-12		
Total dissolved solids	mg/l	56			
Total suspended solids	mg/l	53	0.11-84.0		
Arsenic	mg/l	N.D.	0.005-0.14	0.10	
Antimony	mg/l	N.D.	0.004-0.12		
Free CN^-	mg/l	<.005	<0.005-<0.005	0.2 (0.005 free; 0.02 total)	
Hardness ($CaCO_3$)	mg/l		9.6-65.3		
Magnesium	mg/l		1.5-10.9		
Iron	mg/l	.23	0.02-1.6	1.0	

TABLE 5 (cont.)

Parameter	Units	Value	Typical Background Value Range (baseline impacted)*	Key Instream Standards or Criteria (mg/l)	Comments
Copper	mg/l	.019	0.001-0.004		
Lead	mg/l	.007	.0004-.0026	0.05	
Mercury	mg/l	.0013	0.0002-0.0012	0.002	
Zinc	mg/l	.0.98	0.01-0.01		

*Range for "typical" pre-mining impacted stream; to be utilized for general comparative purposes only.

N.A. - Not Analyzed.

N.D. - Not Detected.

most productive fresh waters. The free cyanide concentration was less than 0.005 mg/l. Heavy metal concentrations were also low.

All values were similar to those for the selected "typical" baseline impacted stream presented in the writeup. This stream, Meadow Creek, is a tributary to the EFSF Salmon River in central Idaho, and is considered essentially unaffected due to its location in the upper reaches above all mining activities at the Stibnite mining operation. Water quality in the lower reach of Meadow Creek is heavily impacted by a large tailing pile from a major antimony/tungsten mining project which operated from 1920 to 1955.

Site 2, Lower Strawberry Creek

Site 2 which is located immediately adjacent to and downstream from the existing tailing pile showed a number of apparent mining-related impacts. The pH value measured at the site was 3, indicating a strong acid-runoff/"groundwater" situation apparently caused by the exposure of sulfide minerals to weathering and erosion (Table 6). This was evidenced by a long reach (estimated 1,000 feet) of the toe of the tailing pile being eroded and washing directly into the stream. This situation will be discussed in more detail in subsequent Technical Memoranda. Electrical conductivity (salinity) measured at the station increased from 110 in the upper reaches to 780 µmhos, which approaches the upper tolerance of a number of fish and aquatic macroinvertebrate species. The free cyanide level remained low.

Heavy metal concentrations including arsenic, antimony, copper, lead, zinc and mercury all were all elevated over the upstream values. For example, arsenic increased from a non-detectable level to .06 mg/l. This compares to a .05 mg/l criteria for cold water fish protection. Iron also increased appreciably between the upper and lower Strawberry Creek site from .23 mg/l to .7 mg/l.

A comparison of these values to a "typical" central Idaho monitoring site located below an abandoned 5 million ton tailing pile showed a number of similarities and several contrasts. The Gilt Edge station demonstrated a much higher potential for acid mine drainage, potentially due to the affect of low pH "groundwater" drainage through the existing tailing pile. The potential for rechanneling Strawberry Creek

TABLE 6

LACANA GILT EDGE, SOUTH DAKOTA MINING, SITE 2
PROJECT ENVIRONMENTAL MONITORING DATA REPORT

Date Sample Collected: June 2, 1984

Conditions: Cloudy early morning, light rain, sun breaking out about noon. Air temperature (ambient) ranged from 12-16.5°C.
Water Temperature: 9.0°C

Sample Site: Site 2, Lower Strawberry Creek

Parameter	Units	Value	Typical Background Value Range (baseline impacted)*	Available Instream Standard	Comments
Turbidity	FTU	N.A.	0.00-14.0		
pH	units	3	6.8-7.6	6.5-8.8	
Electrical conductivity	µmho	780	42-180		
Ammonia (NH_3-N)	mg/l	.18	0.1-0.1		
Nitrate (NO_3-N)	mg/l	<.015	0.1-1.69		
T.K.N.	mg/l	1.83	0.46-1.80		
Total Phos (P)	mg/l	.2	0.01-0.91		
Sulfate	mg/l	241	1.0-22.0		
Total dissolved solids	mg/l	394	N.A.		
Total suspended solids	mg/l	132	0.04-48.0		
Arsenic	mg/l	.06	0.005-0.364	0.10	
Antimony	mg/l	.002	0.005-0.196		
Free CN^-	mg/l	<.005	0.001-0.002	0.005	
Hardness ($CaCO_3$)	mg/l	207	12.8-72.9		
Iron	mg/l	.7	0.01-0.64	1 mg/l	

TABLE 6 (cont.)

Parameter	Units	Value	Typical Background Value Range (baseline impacted)*	Available Instream Standard	Comments
Copper	mg/l	1.5	0.002-0.006		
Lead	mg/l	.002	0.005-0.005	0.05	
Mercury	mg/l	.0017	0.005-0.005	0.0005	
Zinc	mg/l	.42	0.005-0.087		

*Range for "typical" pre-mining impacted stream; to be utilized for general comparative purposes only.

N.A. - Not Analyzed.

out of the tailing area in a similar manner to a mitigation and fisheries/water quality enhancement program at Stibnite is discussed in more detail in a subsequent Technical Memorandum. Electrical conductivity, a measure of salts in solution, was also elevated at the Gilt Edge site. Other key water quality parameters including arsenic, iron, lead and cyanide for the Gilt Edge and Meadow Creek sites were comparable.

Site 3, Upper Bear Butte Creek

Water quality in upper Bear Butte Creek compared similarly to that monitored in upper Strawberry Creek (Site 1), as might be expected. Water quality conditions were generally good, with no apparent exceptions. The pH value indicated slightly acidic water. Free cyanide measured 0.001 mg/l well below the 0.005 mg/l instream standard (Table 7). Heavy metal concentrations for the key parameters were consistently low. Bear Butte Creek does not appear to be heavily impacted by mining or other significant land uses at this time with the exception of low density suburban and recreational development.

Site 4, Lower Bear Butte Creek

This station showed very similar water quality to Site 3 (Table 8). Arsenic and copper concentrations were elevated slightly, although both were with the range which support cold water biota. The free cyanide concentration was low. The iron concentration was above the criterion recommended for cold water biota. This can be attributed to the high background concentrations occurring in the area's geology.

A major stretch of Bear Butte Creek is dammed by a number of small beaver dams which also appear to serve as good temporary sediment detention ponds. These dams were photo-documented. It is unlikely they would provide any long-term sediment control or mitigation, as higher spring streamflows apparently wash out the dammed areas each year.

Site 5, Lower Ruby Gulch Creek

This site is located in the lower reaches of the creek near the confluence with Bear Butte Creek. The existing Cyprus pilot plant is located in the drainage. Water

TABLE 7

LACANA GILT EDGE, SOUTH DAKOTA MINING PROJECT ENVIRONMENTAL MONITORING DATA REPORT, SITE 3

Date Sample Collected: June 14, 1984

Conditions: Overcast, rainy and cool; sunny after 12:00 a.m.; ambient air temperature range = 11-17°C.
Water Temperature: 10.0°C

Sample Site: Site 3, Upper Bear Butte Creek

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Turbidity	FTU	N.A.			
pH	units	6.6		6.5 - 8.8	
Electrical conductivity	µmho	122			
Ammonia (NH_3-N)	mg/l	<.1			
Nitrate (NO_3-N)	mg/l	.10			
T.K.N.	mg/l	1.1			
Total Phos (P)	mg/l	.11			
Sulfate	mg/l	13.7			
Total dissolved solids	mg/l	122			
Total suspended solids	mg/l	24			
Arsenic	mg/l	<.005		0.10	
Antimony	mg/l	<.005			
Free CN^-	mg/l	.001		0.005	
Hardness ($CaCO_3$)	mg/l	55.5			
Magnesium	mg/l	4.5			
Iron	mg/l	3.2		1 mg/l	
Copper	mg/l	.002			

TABLE 7 (cont.)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Lead	mg/l	<.01		0.05	
Mercury	mg/l	<.0005		0.0005	
Sodium	mg/l	2.1			
Zinc	mg/l	.005			

*Range for "typical" pre-mining impacted stream; to be utilized for general comparative purposes only.

N.A. - Not Analyzed

TABLE 8

LACANA GILT EDGE, SOUTH DAKOTA MINING PROJECT ENVIRONMENTAL MONITORING DATA REPORT, SITE 4

Date Sample Collected: June 14, 1984

Conditions: Overcast, rainy and cool; sunny after 12:00 a.m.; ambient air temperature range = 11-17°C.
Water Temperature: 10.5°C

Sample Site: Site 4, Lower Bear Butte Creek (below Strawberry Creek Confluence)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Turbidity	FTU	N.A.			
pH	units	6.5		6.5 - 8.8	
Electrical conductivity	µmho	124			
Ammonia (NH_3-N)	mg/l	<.1			
Nitrate (NO_3-N)	mg/l	1.0			
T.K.N.	mg/l	1.0			
Total Phos (P)	mg/l	.01			
Sulfate	mg/l	41.7			
Total dissolved solids	mg/l	98			
Total suspended solids	mg/l	56			
Arsenic	mg/l	.011		0.10	
Antimony	mg/l	.005			
Free CN^-	mg/l	.001		0.005	
Hardness ($CaCO_3$)	mg/l	58.2			
Magnesium	mg/l	4.0			
Iron	mg/l	2.1		1 mg/l	
Copper	mg/l	.091			

TABLE 8 (cont.)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Lead	mg/l	<.01		0.05	
Mercury	mg/l	<.0005		0.0005	
Sodium	mg/l	1.9			
Zinc	mg/l	.063			

*To be added following fall sampling event.

N.A. - Not Analyzed

quality conditions were generally characterized as good to excellent (Table 9). Numerous parameter swere below the detection limits of current laboratory procedures. No free cyanide was detected in the sample collected at the site. The pH value was 7.2, which is well within the range for most productive fresh waters. Heavy metal concentrations were consistently low.

The stream is spring fed, and flows intermittently through the year. For this reason, it is likely that sampling will be restricted to early and mid-season events.

Site 6, Butcher Gulch Creek

Butcher Gulch Creek drains a large relatively flat basin. As such, the area is a potential location for a full-scale leach plant. A number of early prospects, mine workings and milling remnants are located in the general area. This includes some fairly substantial trenchings near the sampling site.

Water quality conditions at the site were generally good, with the exception of pH which was measured at 5.5 units (Table 10). Electrical conductivity was also slightly elevated. Free cyanide was less than .005 mg/l.

Heavy metal concentrations shows no significant variations from the other monitoring sites. No unusual levels wre measured for the other parameters.

Site 7, Two Bit Creek

This area is relatively flat and gently sloping. The site appeared boggy, was dotted by a number of beaver dams, and is drained from the area of the existing pilot plant facility. Two forks of the creek drain the Anchor Hill area. The western Anchor Hill fork is apparently dry during most of the year. The area drains to the north to Whitewood Creek.

Water quality in the subbasin was extremely similar to that monitored in Butcher Creek. Notable exceptions were pH, which was measured at 7.2, as compared to 5.5 for Butcher Creek (Table 11). Free cyanide showed the highest concentration for all the sites monitored, .021 mg/l. This reading will be redocumented during the fall sampling event.

TABLE 9

LACANA GILT EDGE, SOUTH DAKOTA MINING
PROJECT ENVIRONMENTAL MONITORING DATA REPORT, SITE 5

Date Sample Collected: June 2, 1984

Conditions: Cloudy early morning, light rain, sun breaking out about noon. Air temperature (ambient) ranged from 12-16.5°C.
Water Temperature: 11°C

Sample Site: Site 5, Lower Ruby Gulch Creek

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Turbidity	FTU	N.A.			
pH	units	7.2		6.5 - 8.8	
Electrical conductivity	µmho	160			
Ammonia (NH_3-N)	mg/l	<.014			
Nitrate (NO_3-N)	mg/l	<.015			
T.K.N.	mg/l	2.59			
Total Phos (P)	mg/l	.1			
Sulfate	mg/l	24			
Total dissolved solids	mg/l	94			
Total suspended solids	mg/l	25			
Arsenic	mg/l	N.D.		0.10	
Antimony	mg/l	.006			
Free CN^-	mg/l	<.005		0.005	
Hardness ($CaCO_3$)	mg/l	N.A.			
Magnesium	mg/l	N.D.			
Iron	mg/l	.099		1 mg/l	

TABLE 9 (cont.)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Copper	mg/l	N.D.			
Lead	mg/l	N.D.		0.05	
Mercury	mg/l	N.D.		0.0005	
Zinc	mg/l				

*To be added following fall sampling event.

N.A. - Not Analyzed.

TABLE 10

LACANA GILT EDGE, SOUTH DAKOTA MINING
PROJECT ENVIRONMENTAL MONITORING DATA REPORT, SITE 6

Date Sample Collected: June 2, 1984

Conditions: Cloudy early morning, light rain, sun breaking out about noon. Air temperature (ambient) ranged from 12-16.5°C.
Water Temperature: 10.5°C

Sample Site: Site 6, Butcher Gulch Creek

Parameter	Units	Value	Background Value Range*	Current Instream Standard	Comments
Turbidity	FTU	N.A.			
pH	units	5.5		6.5 - 8.8	
Electrical conductivity	µmho	260			
Ammonia (NH_3-N)	mg/l	<.014			
Nitrate (NO_3-N)	mg/l	<.015			
T.K.N.	mg/l	2.03			
Total Phos (P)	mg/l	.2			
Sulfate	mg/l	111			
Total dissolved solids	mg/l	186			
Total suspended solids	mg/l	29			
Arsenic	mg/l	N.D.		0.10	
Antimony	mg/l	.006			
Free CN^-	mg/l	<.005		0.005	
Hardness ($CaCO_3$)	mg/l	N.A.			
Iron	mg/l	.064		1 mg/l	
Copper	mg/l	1.5			

TABLE 10 (cont.)

Parameter	Units	Value	Background Value Range*	Current Instream Standard	Comments
Lead	mg/l	N.D.		0.05	
Mercury	mg/l	.0005		0.0005	
Zinc	mg/l	.49			

*To be added following fall sampling event.

N.A. - Not Analyzed.

N.D. - Not Detected.

TABLE 11

LACANA GILT EDGE, SOUTH DAKOTA MINING
PROJECT ENVIRONMENTAL MONITORING DATA REPORT, SITE 7

Date Sample Collected: June 2, 1984

Conditions: Cloudy early morning, light rain, sun breaking out about noon. Air temperature (ambient) ranged from 12-16.5°C.
Water Temperature: 10.5°C

Sample Site: Site 7, Two Bit Creek

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Turbidity	FTU	N.A.			
pH	units	7.2		6.5 - 8.8	
Electrical conductivity	μmho	50			
Ammonia (NH_3-N)	mg/l	<.014			
Nitrate (NO_3-N)	mg/l	<.015			
T.K.N.	mg/l	2.29			
Total Phos (P)	mg/l	.1			
Sulfate	mg/l	7			
Total dissolved solids	mg/l	36			
Total suspended solids	mg/l	36			
Arsenic	mg/l	N.D.		0.10	
Antimony	mg/l	.002			
Free CN^-	mg/l	.021		0.005	
Hardness ($CaCO_3$)	mg/l	N.A.			
Iron	mg/l	.25		1 mg/l	
Copper	mg/l	N.D.			

TABLE 11 (cont.)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Lead	mg/l	.002		0.05	
Mercury	mg/l	.054		0.0005	
Zinc	mg/l				

*To be added following fall sampling event.

N.A. - Not Analyzed.

Lead and mercury levels showed slight elevations. The iron concentration was also slightly higher than at Site 6.

Site 8, Abandoned Cyprus Pilot Plant Overflow Pond

A sample was also collected from the abandoned Cyprus pilot plant overflow pond. The principal area of interest was to document background or residual concentrations of free cyanide and heavy metals.

The analyses of the sample showed a free cyanide concentration of .058, the highest for any of the baseline monitoring samples (Table 12). This concentration is above the State of South Dakota criterion for free cyanide, as related to instream concentrations. However, it is below the acceptable EPA criteria for land disposal.

Heavy metal concentrations were below most applicable criteria for cold water permanent fish life propogation. A second sampling of the pond is planned during the fall (September/October).

Site 9, Rattlesnake Winze

The results of this "special analyses" groundwater, which are shown in Table 13, site are discussed in a separate Technical Memorandum which also describes the results of the Cyprus pilot plant ore testing program. This will include a comparison with the Site 2, Lower Strawberry Creek surface water location.

Site 10, Above Double Rainbow Tailing Site

This site is located approximately 100 feet above the Homestake Double Rainbow workings, on Bear Butte Creek. The site was selected to provide an indication of baseine conditions above the abandoned workings.

In general, the water quality at this site is similar to that at Site 3, Upper Bear Creek, which is located above the potential influence zone of the proposed Gilt Edge project. All parameters were relatively consistent with the upstream values. The exception was arsenic, which increased from less than .005 at Site 3 to .011 at the lower Bear Creek Site (Table 14).

TABLE 12

LACANA GILT EDGE, SOUTH DAKOTA MINING
PROJECT ENVIRONMENTAL MONITORING DATA REPORT, SITE 8

Date Sample Collected: June 14, 1984

Conditions: Cloudy early morning, light rain, sun breaking out about noon. Air temperature (ambient) ranged from 12-16.5°C.

Sample Site: Site 8, Abandoned Cyprus Pilot Plant Overflow Pond (Special Analyses)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Turbidity	FTU	N.A.			
pH	units	7.1		6.5 - 8.8	
Electrical conductivity	µmho	970			
Ammonia (NH_3-N)	mg/l	<.014			
Nitrate (NO_3-N)	mg/l	<.015			
T.K.N.	mg/l	10.1			
Total Phos (P)	mg/l	.2			
Sulfate	mg/l	24			
Total dissolved solids	mg/l	60			
Total suspended solids	mg/l	45			
Arsenic	mg/l	.015		0.10	
Antimony	mg/l	.003			
Free CN^-	mg/l	.058		0.005	
Hardness ($CaCO_3$)	mg/l	N.A.			
Magnesium	mg/l	N.D.			
Iron	mg/l	1		1 mg/l	
Copper	mg/l	N.D.			

TABLE 12 (cont.)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Lead	mg/l	N.D.		0.05	
Mercury	mg/l	<.0005		0.0005	
Zinc	mg/l	.017			

*To be added following fall sampling event.

N.A. - Not Analyzed.

N.D. - Not Detected.

TABLE 13

LACANA GILT EDGE, SOUTH DAKOTA MINING PROJECT ENVIRONMENTAL MONITORING DATA REPORT, SITE 9

Date Sample Collected: June 14, 1984

Conditions: Sampled underground; ambient air temperature 4°C.
Water Temperature: 6°C

Sample Site: Site 9, Rattlesnake Winze (*Special Anlayses)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Turbidity	FTU	N.A.			
pH	units	3.2		6.5 - 8.8	
Electrical conductivity	µmho	4580			
Ammonia (NH_3-N)	mg/l	<.1			
Nitrate (NO_3-N)	mg/l	37.3			
T.K.N.	mg/l	.2			
Total Phos (P)	mg/l	.23			
Sulfate	mg/l	2400			
Total dissolved solids	mg/l	2992			
Total suspended solids	mg/l	40			
Arsenic	mg/l	.244		0.10	
Antimony	mg/l	.056			
Free CN^-	mg/l	.005		0.005	
Hardness ($CaCO_3$)	mg/l	611			
Magnesium	mg/l	27			
Iron	mg/l	644		1 mg/l	

TABLE 13 (cont.)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Copper	mg/l	12.4			
Lead	mg/l	1.65		0.05	
Mercury	mg/l	<.0005		0.0005	
Sodium	mg/l	10.6			
Zinc	mg/l	2.12			

*To be added following fall sampling event.

N.A. - Not Analyzed.

TABLE 14

LACANA GILT EDGE, SOUTH DAKOTA MINING
PROJECT ENVIRONMENTAL MONITORING DATA REPORT, SITE 10

Date Sample Collected: June 14, 1984

Conditions: Overcast; rainy and cool; sunny after 12:00 a.m.; ambient air temperature range = 11-17°C.
Water Temperature: 10°C

Sample Site: Site 10, Above Double Rainbow Tailing Site (Bear Butte Creek)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Turbidity	FTU	N.A.			
pH	units	6.5		6.5 - 8.8	
Electrical conductivity	µmho	124			
Ammonia (NH_3-N)	mg/l	<.1			
Nitrate (NO_3-N)	mg/l	1.0			
T.K.N.	mg/l	1.0			
Total Phos (P)	mg/l	.01			
Sulfate	mg/l	41.7			
Total dissolved solids	mg/l	98			
Total suspended solids	mg/l	56			
Arsenic	mg/l	.011		0.10	
Antimony	mg/l	.005			
Free CN^-	mg/l	.001		0.005	
Hardness ($CaCO_3$)	mg/l	58.2			
Magnesium	mg/l	4.0			
Iron	mg/l	2.1		1 mg/l	
Copper	mg/l	.091			

TABLE 14 (cont.)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Lead	mg/l	<.01		0.05	
Mercury	mg/l	<.0005		0.0005	
Sodium	mg/l	1.9			
Zinc	mg/l	.063			

*To be added following fall sampling event.

N.A. - Not Analyzed.

Site 11, Below Homestake Double Rainbow Tailing Site

This site is located downstream from the old mine workings and a several thousand ton tailing disposal area known as the Double Rainbow tailing site. The sample was collected approximately 100 feet (south) downstream from the tailing pile at the confluence of active tailing runoff and Bear Butte Creek. A yellowish-orange waste stream was observed running off the tailings.

The results of the water quality parameter analyses showed similar quality to that measured for the upstream (Site 10) location. One significant increase which should be noted was the increase in arsenic concentration from .011 mg/l at Site 10 to 3.89 mg/l at this station (Table 15). The pH value was also low (6.4 pH units) at the site. Recommendations related to ongoing monitoring of this situation are presented in the section which follows.

ONGOING MONITORING RECOMMENDATIONS

Based upon the results of the initial water quality monitoring at the Gilt Edge project site, the following recommendations are provided by JMM:

1) Water quality monitoring program should be conducted for the second fall field event. This would include all sites monitored during the spring. Also, additional sites may be added on the basis of the faiclities siting evaluation (mine areas, waste dumps, plant site, etc.) to be conducted this season. The objective would be to isolate key potential impact areas, document baseline conditions, evaluate mitigation potential and oportunities (tradeoffs) for a full-scale mining operation. Special attention should be directed to the existing tailing pile at the Gilt Edge site. This would provide baseline information for the low flow event.

2) Additional analysis of the Rattlesnake "winze" site and implications will be presented in a subsequent Technical Memorandum. This will include a discussion on groundwater quality/supply, and relationships to the leaching process and treatment and waste disposal needs.

TABLE 15

LACANA GILT EDGE, SOUTH DAKOTA MINING
PROJECT ENVIRONMENTAL MONITORING DATA REPORT, SITE 11

Date Sample Collected: June 14, 1984

Conditions: Overcast; rainy and cool; sunny after 12:00 a.m.; ambient air temperature range = 11-17°C.
Water Temperature: 10°C

Sample Site: Site Site 11, Below Homestake Double Rainbow Tailing Site

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Turbidity	FTU	N.A.			
pH	units	6.4		6.5 - 8.8	
Electrical conductivity	µmho	154			
Ammonia (NH_3-N)	mg/l	<.1			
Nitrate (NO_3-N)	mg/l	.25			
T.K.N.	mg/l	1.2			
Total Phos (P)	mg/l	.11			
Sulfate	mg/l	51.7			
Total dissolved solids	mg/l	166			
Total suspended solids	mg/l	58			
Arsenic	mg/l	3.89		0.10	
Antimony	mg/l	<.005			
Free CN^-	mg/l	.001		0.005	
Hardness ($CaCO_3$)	mg/l	65.2			
Magnesium	mg/l	6.0			
Iron	mg/l	2.2		1 mg/l	
Copper	mg/l	N.D.			

TABLE 15 (cont.)

Parameter	Units	Value	Background Value Range*	Available Instream Standard	Comments
Lead	mg/l	.01		0.05	
Mercury	mg/l	<.0005		0.0005	
Sodium	mg/l	1.9			
Zinc	mg/l	1.9			

*To be added following fall sampling event.

N.A. - Not Analyzed.

3) Additional discussion of the analyses results for the Cyprus pilot plant overflow pond and treated ore leach residue tests will be provided in a forth-coming memorandum.

4) A fisheries/aquatic macroinvertebrate sampling program keyed to the water quality monitoring program should be developed and implemented during fall, 1984. At Lacana's direction, JMM is currently developing a program outline, and anticipates finalizing the program with Lacana and the subcontractor during the first two weeks in September, to allow for October field time.

5) Other recommendations related to heavy metal leachate testing and the "beneignity" of cyanide-treated ore are currently being implemented, at Lacana's direction.

6) A "refined" version of this report should be submitted to the DW&NR following the final sampling event in September/October. This would involve non-proprietary information.

7) Lacana should request historical information from Cyprus (Amoco) related to the abandoned tailing pile including potential reclamation commitments, cleanup programs, previous correspondence with the DW&NR and other pertinent data.

8) Lacana should request background material related to the neutrailization for the pilot plant including CN solutions and CN-treated ore. A description of the previous de-commissioning process should also be included. Reclamation requirements involving existing bonds, responsibilities, commitments and potential schedules discussed with DW&NR during the site visit and currently in force should be identified.

9) At your direction, I will submit a copy of Technical Memorandum No. 4 - Treated Ore Testing program, to Bob Townsend (DW&NR).

10) Lacana should review with their Legal Counsel the need to verify the State's unofficial position regarding the abandoned tailing pile, specifically with regard to use of the tailing material for sub-base for a full scale leaching facility, and long-term cleanup/liability considerations. This is particularly relevant as related to documentation of existing water quality conditions. Also, Bill Boyd, a local attorney in Kellogg, Idaho has considerable experience with these types of potential problems through his work at Bunker Hill, and could be consulted if necessary.

11) As previously noted, it may be advisable to review the potential cleanup opportunities related to the abandoned tailing pile throughout the project planning and development phases, based on existing legal constraints. These opportunities should be evaluated in terms of potential tradeoffs (i.e., those cleanup opportunities which could result in Lacana making progress toward program implementation). These will become particularly important as company designs the "proposed project" and approaches a development decision on the property.

12) Once the final results of the testing program are written up, Lacana may want to consider requesting a formal determination from DW&NR concerning whether the Cyprus (Amoco) pilot plant site is a hazardous waste or solid waste disposal site. That is, does the waste ore and remaining facilities constitute a waste disposal site. If warranted, I will draft a letter to Kevin Tveidt (DW&NR) concerning this matter. I suspect the results of the "treated" ore testing we are currently conducting will influence the State's decision. I will be preparing a follow-up memorandum on the results of the testing and monitoring analyses, as the results become available.

910 DENVER CENTER BUILDING
1776 LINCOLN STREET
DENVER, COLORADO 80203

TELEPHONE 303-861-8140

File Gilt Edge Agreement.

CONGDON AND CAREY
MINERAL EXPLORATION

October 4, 1978

TO	REPLY
C D M	COMMENT
RETURN TO	
OCT 6 1978	
1	5
2	6
3	7
4	8

Mr. John Mattson
Driscoll, Mattson, Richetto & Christensen
P.O. Box 392
Deadwood, South Dakota 57732

Dear Mr. Mattson:

Re: Commonwealth Mining Company
of South Dakota

I believe some degree of misunderstanding arose with respect to this organization's interest in the property of the subject company in Lawrence County, South Dakota. I neglected to answer your letter of April 12, 1978 to Mr. Dolf Fieldman, our consulting geologist, as I understood a response was called for only if we were interested in altering the terms of our agreement with Commonwealth to negotiate a lesser but immediate purchase price. Please accept my apology for not responding, but our work has not yet brought us to the point that any value--other than speculative value--can be attributed to the property.

I consider we are in full compliance with all the terms of the Lease and Option to Purchase Agreement, dated October 16, 1974, between Commonwealth Mining Company of South Dakota and myself, such agreement held by me in behalf of Congdon and Carey Ltd. 5 and our major company partner, Cyprus Mines Corporation. That agreement is of record in Book 418 at Pages 264-284. The term of this agreement, including the option to purchase contained therein, runs until October 15, 1989 and for so long thereafter as minerals are produced in commercial quantities from the premises. The very high purchase price of $2,500,000 was not--and is not now--indicative of any present value of a projected stream of royalty income Commonwealth might expect from the property; the figure was simply chosen as a very generous prospective total of possible royalty payments, after which title to the property would vest in me, my associates and assigns and no earned royalties would be payable.

Mr. Lagos is forwarding you under separate cover copies of our affidavits with respect to work commitments under Article III. The minimum requirement of $300,000 was completed by October of 1976 and evidenced by affidavit dated July 26, 1977. Terms of the agreement permitted a completion date of such work as late as January 16, 1980.

Paragraph 2.11 authorizes Commonwealth representative access at all reasonable times to our records of exploration and drilling. These records are very voluminous; complete records are available for examination in the office of Cyprus' consultant in Carson City, Nevada; nearly complete records are available in our Denver office and the Los Angeles office of Cyprus Mines Corporation. I feel the affidavits of Mr. Lagos evidence our compliance with the work commitment. However, if there is some summary of the exploration activity your client desires, we would be happy to make such available.

I understand Commonwealth may have an opportunity to sell the property to a third party--perhaps as recreation land. Yet I and my associates have paid substantial advance royalties in cash for the privilege of tying up the property and, further, have expended almost $600,000 to date in an effort to determine the economic feasibility of exploiting the mineralization known to exist on the property. Should some third party wish to purchase the property from Commonwealth, subject to the existing Lease and Option to Purchase Agreement, we would have no objection to the transaction.

Until the economic feasibility of the property is determined by Cyprus and ourselves, we are not in a position to negotiate an immediate purchase of the property.

Very truly yours,

Thomas E. Congdon

ah

cc: Mr. R. E. Meyer
P.O. Box 995
Oshkosh, Wisconsin 54901

Mr. Cliff Mark
Cyprus Mines
555 South Flower Street
Los Angeles, California 90071

Hardy Schmidt

Compton + Carey file

Alan B. - for review & consideration. Please return. We will need to answer this. Cliff

DOLF W. FIELDMAN
GEOLOGIST-MINERAL EXPLORATION
243 EAST 19TH AVENUE NO. 216
DENVER, COLORADO 80203
(303) 831-4079

November 29, 1979

X-Copies to Hardy S. Pete L. for Comments Sam

Mr. Clifford A. Mark, Manager of Exploration
Cyprus Mines Corporation
555 South Flower Street
Los Angeles, California 90071

Re: Gilt Edge, South Dakota

Dear Cliff:

The recent rapid rise in the gold-silver price, our experience with several other precious metal projects and the data contained in the Gilt Edge 1978 Report all show that another approach to mining and processing Gilt Edge ores may be warranted. The following presents the facts and an apparent solution for your consideration.

Reserves as presently estimated are 10 million tons of ~~.050 oz Au and approximately .30 oz Ag per ton.~~ Using prices of $300 Au oz and $10 Ag oz, a value of ~~$18 per ton~~ is shown. Metallurgical work to date shows widely varying recovery of Au from 55% to 90%. ~~Rates of recovery attributable to~~ tons of rock with variable leachability has not yet been established. Yet, overall recoveries from leaching appears to be in the range of 60 to 70%.

Gross value can

Siting of leach pads and a leaching facility is another difficult problem. The only location within easy reach is on the broad ridge on whose south flank the reserves are located. Since the area is subject to flash floods, containment will be difficult, and approval of an EIS more difficult. Several years of delay should be anticipated.

There is, in addition, the problem of leaching in an area with a severe winter climate. Production could be limited to 8 months a year.

The Homestake mill is located approximately 4 ¼ airline miles from the Gilt Edge reserves. It is presently being operated at a rate considerably below its rated capacity of 8,500 tons per day. There may be as much as 2,000 tpd of excess mill capacity. The Homestake annual report indicated Au recovery of 92% through the mill.

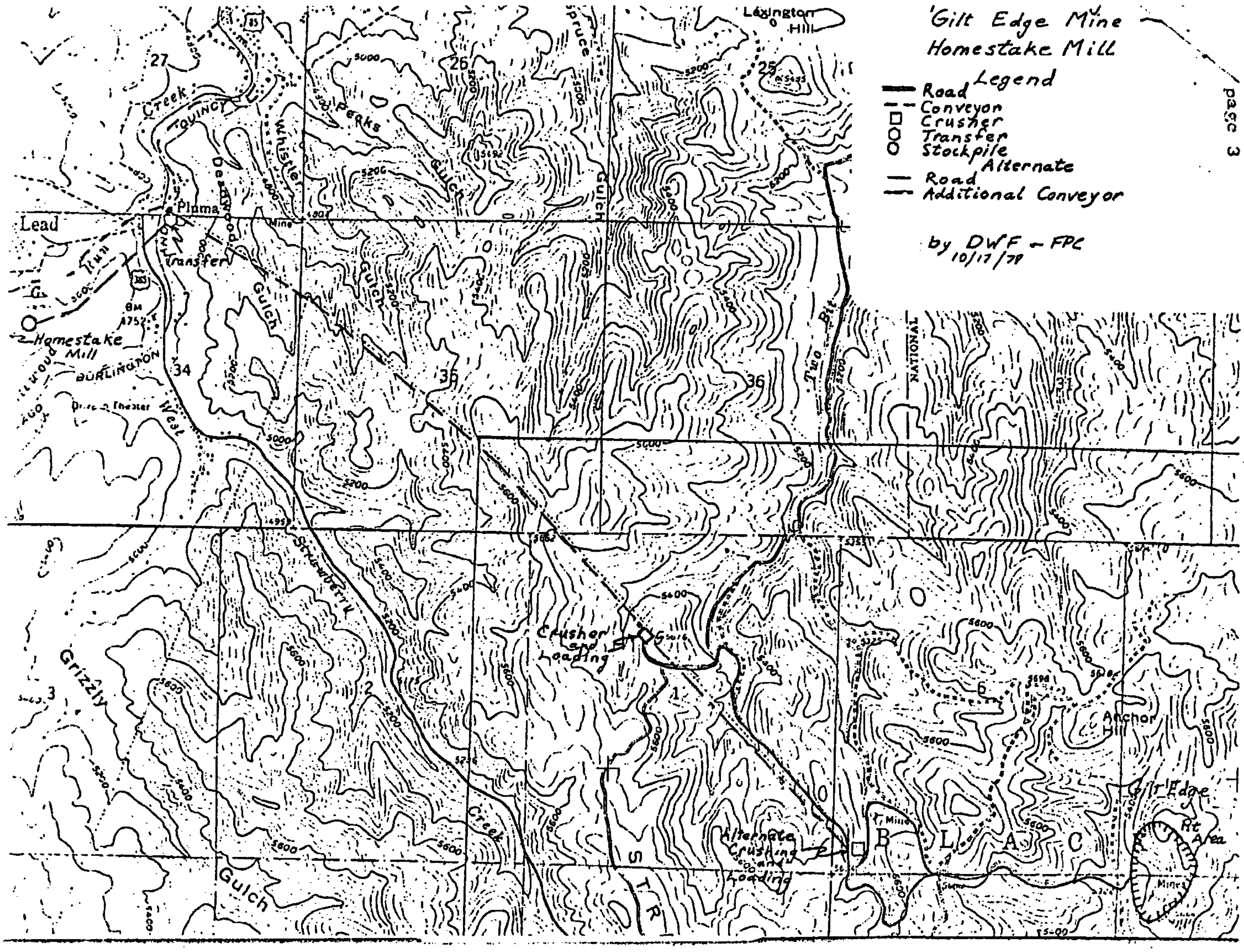
Homestake operated at a loss when gold was selling at $140 oz, but very profitably the first nine months of this year.

----- ----- -----

Perhaps, Gilt Edge ore could be mined and crushed, then transported to the Homestake mill.

On the attached map, it can be seen that a crusher station can be located on the ridge near the power line. The haul to this point from the mine is less than two miles. The ore, after crushing could be conveyed by belt a distance of about 2¼ miles to the mill and there blended with Homestake mine ores - if they are compatible.

The Main U.S. Highway route for direct truck conveyance to the mill is much longer and probably unable to sustain heavy and continous truck haulege.


Gilt Edge Mine
Homestake Mill
Legend
Road
Conveyor
Crusher
Transfer
Stockpile
Alternate Road
Additional Conveyor
by DWF - FPC
10/17/79
Lexington Hill
Lead
Pluma
Transfer
Homestake Mill
Burlington
Deadwood Gulch
Whistler Gulch
Peeks Gulch
Spruce Gulch
Two Bit
National
Strawberry Ck
Grizzly Gulch
Creek
Crusher and Loading
Alternate Crushing and Loading
Anchor Hill
Gilt Edge
Pit Area
Mine
B L A C
S T R

A comparison of estimates of the leaching method and possible utilization of the existing Homestake mill follows on the next page. Given 10 million tons of $18 rock in place, 2,000 ton per day production rate:

Gilt Edge-Alternative to Leaching

	HOMESTAKE MILL ROUTE		LEACHING ROUTE	
Capital Investment	$4.5 million (includes surge bins & etc. at mill)		$10 million (includes $1.5 million for land purchases needed for leach pads)	
Time to Production	1 year		4 years	
Costs	mining, crushing and transport	$3.00	mining, crushing, leach emplacement, restacking	$4.00
	direct mill	4.00	leaching	2.00
	return of capital	.45	return of capital	1.00
Total operating & return of capital		$7.45 tn		$7.00 tn
Recovery	90%	16.20 tn	60%	10.89 tn
	(based on 92% recovery of Homestake rock)		70%	12.60 tn
Gross opr. Profit		8.75 tn	at 60% recovery	3.80 tn
			at 70% recovery	5.60 tn
Royalty	5% of opr. profit (est. from more complicated formula)	.45 tn	at 60% recovery	.19 tn
			at 70% recovery	.28 tn
Net opr. Profit		$8.30 tn	at 60% recovery	$3.61 tn
			at 70% recovery	$5.32

Using these figures as a base case and assuming that Homestake would be agreeable to a 50% operating profit through the mill ($2.00 per ton) coupled with an opportunity for greater profits with an increasing gold price, their share works out at 37% of the gross recovered, i.e. 37% of $16.20 or $6.00 per ton.

That leaves a $6.30 operating profit for the mine operators, still clearly better than can be done by a leaching operation. Even if leach recovery could be increased to 80% and the net operating profits equal, the three year delay in production start-up and the higher capital costs of leaching show a substantially higher ROR for the Homestake mill route.

These figures need a finer engineering hand but experience tells me they are in the ball park. The greatest variables appear to be Homestake mill costs, and recovery of Gilt Edge ores in the Homestake mill.

Please let me know of your reaction to this proposal. We, Congdon & Carey, have worked with some of the Homestake people, and would be pleased to arrange a meeting with them.

Best regards,

Dolf W. Fieldman,
Consultant to Congdon
& Carey

DWF:ds
cc: T. [illegible] Congdon
C. [illegible] Mitchell

SOUTH Dakota Department of
Water & Natural Resources
Joe Foss Building
Pierre, South Dakota 57501

June 21, 1982

Mr. George Allen Trabits
Senior Staff Environmental Engineer
Amoco Metals Company
P.O. Box 3299
Englewood, Colorado 80155

Dear Mr. Trabits:

We have received your letter dated May 26, 1982 detailing the events surrounding the overflow of Amoco's heap leach process ponds in late May. I appreciate your prompt reporting of these matters.

As you probably realize, the Clean Water Act Amendments of 1981 require that all point source discharges of process water be regulated through the NPDES system. In consideration of this requirement, it is apparent that the discharge which occurred on May 20-21, 1982 at the leach facility was unauthorized.

I realize that Amoco is close to terminating work on the heap leach project, and will be eventually dismantling and removing most of the facility including the heap rock. In the mean time, depending on how long you anticipate operating the facility, it is recommended that an application for an NPDES permit be submitted through our office. I feel that such application should be made immediately, especially if the facility is to be left in place beyond September of 1982, since a period of 6 months is typically required for attainment of the NPDES permit.

Please get back to me soon with regard to your future plans for the heap leach.

Respectfully,

Steve Stampfli

Steve Stampfli
Director
Surface Mining Program
Telephone (605) 773-4201

cc: Leon Schochenmaier

A61512SS.sm

BC6014012

MEMORANDUM

DATE: 2/1/77

TO: T.E. Congdon, W. J. Carey, W. I. Auran

FROM: D. W. Fieldman

SUBJECT: GILT EDGE 1977 PROGRAM

I talked to Joe Worthington of Cyprus this morning in regard to their budget for this project. They have not yet received approval but have requested to go forward at the same pace as last year. That is $200,000 overall, Congdon & Carey No. 5 share $40,000.

They have recalculated the reserves, reducing the tonnage somewhat. They are now 8 million tons at a minimum grade of .05 with a range to .075 oz/ton Av.

The work this year will be some additional drilling to firm up grade and attempt to extend the tonnage on N. W. Metals ground. Most work will be on a bulk heap-leaching test.

I suggested, since the evidence indicates that the gold is held within the pyrite in the sulfide zone, that an attempt be made by flotation or heavy media to make a simple pyrite concentrate. This could possibly be sold or tolled at the Homestake mill, only ten miles distant. Homestake now has excess mill capacity.

Worthington seemed enthused by this and will investigate the possibility with Jim Anderson. It may be a low capitol cost way to eventual operation.

Cyprus Mines Corporation — Interoffice Correspondence

To C. A. Mark — Date May 12, 1977

From J. E. Worthington

Subject TUNGSTEN AT GILT EDGE

As a follow-up to Dolf Fieldman's (Congdon and Carey) suggestion that there might be tungsten values in the Gilt Edge mineralization, we have requested tungsten assays of the core samples currently being tested at Cyprus Research Lab. They report as follows:

Sample	% WO_3
GE 1 - Dakota Maid sulfide	0.04
GE 2 - Dakota Maid oxide	0.04
GE 3 - Sunday	0.02

Coarse rejects of these samples were lamped in Philipsburg and there is no obvious scheelite and perhaps only a trace of powellite. The tungsten mineral may be hubnerite or perhaps some other tungsten mineral. The values could probably be recovered only in a conventional flotation mill but low grade in both tungsten and gold suggest that economics of such an operation would be questionable. Some additional and more detailed assaying of known core intervals is warranted to better determine tungsten grade and mineralogical association. It might also be important to see whether Cyprus Research Lab could determine the mineral phase in which tungsten is present.

J. E. Worthington

JEW:dmp

CYPRUS

910 DENVER CENTER BUILDING
1776 LINCOLN STREET
DENVER, COLORADO 80203

TELEPHONE 303-861-8140

Return to C.A. Mark for response.

Pat: Please send X-Copies to
1) Don Kappes
2) Pete Chapman
3) Hardy Schmidt.
For response to questions asked. Most will be answered by a report from Don Kappes. Cliff

CONGDON AND CAREY
MINERAL EXPLORATION

May 2, 1980

Mr. Alan A. Bakewell
Cyprus Mines Corporation
555 South Flower Street
Los Angeles, CA. 90071

Dear Mr. Bakewell:

Re: Gilt Edge Property

In an effort to keep ourselves better appraised of developments with respect to metallurgical research on the Gilt Edge orebodies, it would be appreciated if you could supply us with certain additional information.

(i) In D. W. Kappes' memo to you of 31 December 1979, he refers (bottom of page 4) to bottle roll tests on 200 samples of drill hole cuttings. Could we please have photocopies of the worksheets showing the results of these tests. Has work been started on the remaining 300 samples in this test program? We would also like to receive the worksheets and any reports or memos with respect to the bucket leach tests program on the 21 bulk samples. (One set of tests on 5/8 inch crushed material and one set on 2 inch crushed material).

(ii) Has work started yet on the two test programs itemized on page 7 of Kappes' memo?

(iii) What is the status of the cyanidation tests on the 2,100 pounds of drill samples from the tailings piles?

(iv) Has any decision been taken on a field heap leach test program during the 1980 field season?

It would also be appreciated if we could have a copy of Kappes' summary letter dated 18 September 1979 together with any other memos or progress reports that may have been issued during 1979 or 1980 with respect to metallurgical testwork.

In reviewing our Gilt Edge files, I found a remark by Dolf Fieldman to the effect that tungsten was found in one drill core sample. He also suggested that drill reject samples might be checked for uranium content. Apparently Dolf thinks there is a strong geologic

similarity between the Gilt Edge property and a Tertiary intrusive body at Bald Mountain, a short distance away. Uranium was mined in the Bald Mountain area during the 1950's. Has Cyprus ever assayed core or cuttings for uranium or tungsten values?

In Pat Colville's July 1976 progress report, he discusses certain flotation tests (pages 8 through 11) to produce a pyrite concentrate. If any of that concentrate still remains, could assays for Fe, Cu, Zn, and Pb be performed on the sample?

Thank you for your assistance with our inquiries.

Very truly yours,

J. C. Mitchell

ah

FRANK A. SEETON, P.E.
Consultant - Mineral Processing
1615 UNION DRIVE
DENVER, COLORADO 80215
PHONE (303) 237-6822

MEMORANDUM

To: Hugh J. Matheson

February 18, 1983

From: Frank A. Seeton

Subject: GILT EDGE GOLD PROJECT - LAWRENCE COUNTY, SOUTH DAKOTA

You furnished me with a collection of leach test reports on ores from the Gilt Edge property performed by Kappes, Cassiday & Associates (formerly Miller-Kappes Company) during 1978 to 1982. You requested me to review the reports and submit a brief response giving my opinion as to whether the Gilt Edge ores should be treated by heap leaching or an agitated cyanide leach. I was also asked to discuss this project with J. J. Dworatzek, Staff Metallurgist, Amoco Minerals Company.

Extensive investigations have been performed using bucket leach and bottle roll test procedures as well as a 1700 ton (12' High) field test heap and four on site tests using 4-ft. diameter by 40-ft. high concrete columns. The results to be expected by heap leaching can be summarized as follows:

	Oxidized* Average Recovery	Unoxidized Average Recovery
Sunday Zone	55-65%	45-60%
Dakota Maid Zone	50-55%	30-45%

*Tentatively, about 1/3 of the 10-million ton reserve of 0.05 oz Au/ton is believed to be in the oxidized category.

Kappes did not run tests to optimize an agitation leach flow-sheet, but he concluded that an average recovery of 76% of the gold should be realized by this method. He also stated that this recovery seemed to agree with reports of early day milling operations on the property.

Conclusion

1. The Gilt Edge ores tend to be complicated and to exhibit various characteristics that preclude consistent recoveries by heap leaching and agitated leaching. This is particularly evident with the sulfide-bearing ores or deeper ores within the deposit.

2. Heap leaching can only be considered as a potential method of treatment for the oxidized ores. Agitated leaching is a questionable alternative when considering the low grade nature of the deposit and the wide fluctuations in recovery.

3. Amoco Minerals performed a limited amount of test work on pyrite-bearing Gilt Edge ore at their Cymet laboratory near Tucson. They achieved recoveries of about 35% by straight agitation leaching and concluded that much of the gold in their particular sample was closely associated with the pyrite. They followed this testing by producing a flotation sulfide concentrate which was subsequently roasted and cyanided to obtain a 90% recovery. This information was obtained from my telephone conversation today with Joe Dworatzek.

4. Based on the above, it is evident that test work involving flotation should be performed before any treatment method is selected. Flotation may not apply to all Gilt Edge ores, but it stands a good chance of being the preferred method for much of the orebody. The concentrate would be shipped to a smelter or roasted and treated by cyanidation. In some cases, cyanidation of the flotation tailing might be needed.

Frank A. Seeton
Consulting Engineer

FAS/h

LACANA

LACANA GOLD INC.

MEMORANDUM

TO: Reno/Coeur d'Alene/C. Marshall DATE: 1/9/85

FROM: E. G. Thompson cc: File

SUBJECT: Gilt Edge

Notes on meeting in Denver, Jan. 9, 1985 at Amoco's office.

Present: Herm Bauer, Ed Wozniak, Ralph Godell, Ron Grachen, Bill Burton of Amoco; Lee Freeman of Coca; Wayne Cavender and E. G. Thompson of Lacana.

I proposed an economic force majeure to delay our work commitments while gold is under $400 US. Bauer is adamant against it because of production commitments on the Commonwealth property - 1989. Look at leases - possibly discuss buyout of Commonwealth ($2.5 million in present agreement). Bill Lagos of Coca knows the group.

They will extend our June, 1985 $1.5 million commitment until year-end if we do additional exploration. Bauer was talking of $250,000 in exploration which I was trying to play down. I told him we would be reviewing this week.

I promised both Amoco and CoCa Dec. 31, 1985 report on the project with a breakdown of expenditures. Also an EIS for CoCa.

Paul should review exploration ideas with Grachen. They want to do some drilling on Crown Point-Blackhawk ground and in the Orofina area.

We will likely need to make a limited production decision by the end of 1985 as Amoco look pretty firm because of the underlying leases. Please give serious consideration to all alternatives.

I told Amoco we would get back to them in a week or so with a 1985 budget and exploration proposal.

G/T Edge File

CoCa Mines

CoCa Mines Inc. • 910 Denver Center Building • 1776 Lincoln Street • Denver, Colorado 80203 • (303) 861-5400

May 22, 1985

VIA TELECOPIER

Mr. A.G. Humphrey
Amoco Minerals Company
7200 South Alton Way
P.O. Box 3986
Englewood, Colorado 80155

RE: AMENDMENT TO LACANA AGREEMENT

Dear Art:

Further to our telephone conversation, this will confirm our understanding that in the lease year 6-1-84 through 5-31-86 Lacana will be required to spend on Evaluation Expenditures not less than U.S. $1,250,000.

CoCa would also like to see inserted into the Amending Agreement language to the effect that in consideration for the one year extension to the agreement, Lacana will diligently pursue environmental permitting and engineering related to the preparation of a preliminary feasibility study.

Yours very truly,

Chris

J.C. Mitchell

JCM:vlf

Enc.
0745j